Conceptual Sampling and Analysis Plan for Sediments in the Montrose Site Surface Water Drainage Pathway

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1.0 Project Description and Objectives

The Montrose Chemical Corporation operated a DDT manufacturing and formulation facility at 21201 South Normandie Avenue in Los Angeles, California from 1947 to 1982 (Figure 1). The Montrose facility occupied approximately 13 acres (the property) located in the City and County of Los Angeles. The facility was dismantled in 1983. Most of the property was regraded and capped by Montrose in 1985 (CH2M HILL, 1992).

Releases from the facility have occurred via groundwater, air, and surface water. Montrose was included on the National Priorities List in 1989 and the Superfund Site (the site) includes the property, the surface soil surrounding the property, the underlying contaminated groundwater, the sanitary sewers, and the surface water drainage pathway. The surface water drainage pathway includes Normandie Avenue Ditch (including Jones Ditch), Kenwood Drain, Torrance Lateral, the Dominguez Channel, and the Consolidated Slip (Figure 2) (CH2M HILL, 1993).

The overall goal of the proposed sampling is to evaluate the potential for mobilization of DDT-contaminated sediments from the surface water drainage pathway to downstream habitats. Specific objectives of the sampling effort are as follows:

1. To assess current sediment distribution and concentrations of DDT (and its metabolites and isomers) in sediments within the surface water drainage pathway leading from the Montrose site.
2. To verify and update the sediment sampling results obtained during the 1994 CH2M HILL sampling event, which are summarized in the Field Report – Surface Water, Sediments, and Biological Sampling in the Stormwater Pathway from Montrose Chemical Company to Los Angeles Harbor (CH2M HILL, 1995).

3. To obtain more information regarding Montrose site- vs. non-site-related DDTs through sampling of selected upstream areas that are not be influenced by runoff from the Montrose site.
4. To provide stakeholders with sufficient information to make decisions regarding completion of the human health and ecological risk assessments, or recommendation for remedial action.

The proposed sampling effort will focus on sediments in the surface water drainage pathway downstream to the Consolidated Slip. In addition to the areas sampled previously (CH2M HILL, 1995), the Upper Dominguez Channel, which lies upstream of the northern point of tidal influence (Figure 2),the upstream portion of the Kenwood Drain, and the upper portion of the Torrance Lateral, above its confluence with the Kenwood Drain (Figures 2 and 3) will be included in the sampling effort to provide information on site-related vs. Non-site-related contamination. The analyses of sediment samples will be limited to Montrose site-related organochlorine pesticides, specifically, dichloro diphenyl trichloroethane (DDT) and its metabolites (DDE and DDD) and isomers (2,4′- and 4,4′-). Proposed sampling locations are shown in Figures 4 through 7.

This technical memorandum provides a review of site background (including previous sampling and results), and describes the proposed sampling to provide current information on the distribution and characteristics of sediment within the drainage pathway.

2.0 Site Background

The Montrose property is currently capped with asphalt. The surrounding areas within a 1-mile radius are heavily developed with industrial, commercial, and residential land uses. Normandie Avenue and the Southern Pacific Railroad right-of-way border the property to the east, the Jones Chemical Company and the Los Angeles Department of Water and Power are located to the south, and McDonnell-Douglas is located to the west and north. The City of Torrance is also to the west of the property beyond Western Avenue. A relatively new (1992) residential area was developed on the east side of the Montrose property along the west side of the San Diego Freeway. There are some areas of open land to the northeast of the site which include the former Ascot Speedway, the Goodyear Airship Field, and a large cemetery. Arco, Chevron, and Texaco operate oil refineries to the south of the Montrose site along the southern reach of the Dominguez Channel, and the Champlin Petroleum Company operates a pumping field to the east of the Consolidated Slip. Harbor Regional Park is located approximately 4 miles south of the Montrose property and consists of a golf course, freshwater marsh, and Harbor Lake (CH2M HILL, 1993 and 1995).

2.1 Topography and Surface Drainage Pathways

Montrose is located on the Torrance Plain which is approximately 50 feet above mean sea level (msl). Historically, stormwater from the Torrance Plain flowed south and east through natural drainages toward present-day Los Angeles Harbor. The City of Los Angeles began developing the stormwater drainage system in the 1920s. It includes natural drainages and man-made ditches and channels (CH2M HILL, 1992).

The Normandie Avenue Ditch is a concrete catchment that runs south along the west side of Normandie Avenue to a catchment for the Kenwood Drain storm sewer system (Figure 3).

The Kenwood Drain (County of Los Angeles Public Works Projects 685 and 1250) is a buried concrete storm sewer system that drains to the south beneath Kenwood Drive and then travels east beneath 209th Street until it merges with the Torrance Lateral (Figure 3). The Kenwood Drain was a natural drainage channel until the installation of the concrete drain in 1973.

The Torrance Lateral (County of Los Angeles Public Works Projects 1153 and 1232) is a fenced, open drainage with portions that are both lined (concrete bottom and sides) and unlined (Figures 2 and 3). It is predominantly dry, carrying intermittent stormwater runoff from rain events and urban runoff from industrial, commercial, and residential areas. The Torrance Lateral receives drainage from the area bordered by the San Diego Freeway to the north, Sepulveda Boulevard to the south, and the City of Torrance to the west (LACDPW, 1991) (Figure 2). Stormwater in the Torrance Lateral flows eastward until it empties into the Dominguez Channel.

The Dominguez Channel (County of Los Angeles Public Works Project 688) is a flood control drainage that bisects the Torrance Lateral and discharges into the Consolidated Slip just south of the Henry Ford Avenue bridge (Figure 2). The confluence with the Torrance Lateral is approximately 5 miles upstream of the Consolidated Slip. The channel is tidally influenced as far north as Vermont Avenue. The reach below Vermont Avenue is constructed of stone revetment or riprap sides with a 5-foot-thick, compacted clay bottom. The reach above Vermont Avenue is a narrower channel with concrete bottom and concrete revetments (CH2M HILL, 1992).

Consolidated Slip is the uppermost portion of Los Angeles Harbor that receives the drainage from Dominguez Channel. It is approximately 3000 feet long, 300 to 500 feet wide, and 25 feet deep. It ends at a constriction at the north end of the east basin where it joins the Los Angeles Harbor (CH2M HILL, 1992).

During the years of active operation at the Montrose facility, stormwater runoff flowed from the property into the Normandie Avenue Ditch where it entered the City of Los Angeles drainage systems (i.e., Kenwood Drain, Torrance Lateral, Dominguez Channel, Consolidated Slip, and Los Angeles Harbor). Runoff from the east side of the property flowed to the southeast corner of the property where it entered a culvert leading off the property and discharged in the Normandie Avenue Ditch. Runoff from the west side of the property flowed south onto the Jones Chemical property where it either entered the Jones Ditch or continued south to the Farmer Brothers Coffee property. Jones Ditch followed a railroad spur running southeast on the Jones Chemical property before it emptied into the Normandie Avenue Ditch (CH2M HILL, 1992).

Currently, stormwater from the Montrose site flows around the elevated pads, that were created during regrading of the property, toward the southeast corner where it either flows under the perimeter fence onto the railroad spurs and into the Normandie Avenue Ditch or runs into a culvert that drains into the Normandie Avenue Ditch (CH2M HILL, 1992).

2.2 Summary of Ecological Site Investigations

Remedial investigation and feasibility study (RI/FS) activities have been conducted at the site since 1985. Numerous studies have been conducted at the site to support the RI/FS including sampling and analysis of surface and subsurface soil, groundwater, sediment, and surface water. These studies are summarized in the RI report and were evaluated in the Phase 1 EcoRA (CH2M HILL, 1992). The ecological investigations described in this section include those conducted on portions of the surface water drainage pathway by the State of California - Toxic Substances Monitoring Program, State Mussel Watch Program, and the Bay Protection and Toxic Cleanup Program as well as RI/FS-related investigations - the Phase 1EcoRA (CH2M HILL, 1992) and the Phase 2 surface drainage pathway investigation (CH2M HILL, 1993 and 1995). The studies are discussed in chronological order based on the start year of the investigation or availability of data related to the surface drainage pathway. Table 1 summarizes the results of the sampling efforts within the Consolidated Slip conducted by other agencies (CSWRCB et al., 1998) and CH2M HILL (CH2M HILL, 1995).

Phase 1 Ecological Risk Assessment

the Phase 1 EcoRA was conducted as part of the RI/FS to address those areas of the site that were potentially affected by environmental releases of chemicals of concern through surface drainage and atmospheric transport (CH2M HILL, 1992). The conclusions of the Phase 1 EcoRA are summarized as follows:

- “The Montrose property is a source of contamination for downstream and downwind areas, particularly for DDT and its metabolites.
- Chemicals of greatest concern are those that a) persist in soils and sediments in the study area, b) are toxic at concentrations found in those media or in surface water, c) tend to bioaccumulate in animals exposed to them. Available data indicate that DDT and its metabolites are the primary chemicals of ecological concern (COECs).
- Ecological receptors in downstream areas (primarily the Dominguez Channel and Consolidated Slip) include aquatic invertebrates, fish, and semi-aquatic birds. These species are exposed to chemicals in the sediment and surface water through ingestion and dermal contact that can result in toxic effects and bioaccumulation of chemicals.
- Waterborne concentrations of DDT have exceeded water quality criteria in the Torrance Lateral. Maximum observed concentrations of DDT and BHC in the Dominguez Channel and Consolidated Slip cannot be evaluated because the detection limits were at or above the acute and chronic criterion for those chemicals (and because water solubility is very low).
- Concentrations of DDT, DDE, and DDD in sediments at the intersection of the Dominguez Channel and Torrance Lateral exceed levels associated with reported adverse effects in biota or those that have been suggested as sediment criteria.
- Chemical concentrations have not been measured in biota from the surface drainage systems, but bioaccumulation of DDT and metabolites by aquatic invertebrates and fish is expected to reach levels causing adverse effects in fish and birds consuming them. Bioaccumulation of other chemicals is not expected to be significant due to their lower soil affinity.

- Concentrations of DDT in surface soils within 0.75 mile of the Montrose property frequently exceeded 10 mg/kg. Although numerical criteria for evaluation of these concentrations are not available, bioaccumulation of DDT (and particularly DDE) into the terrestrial food webs can be expected to occur. A bioaccumulation ratio of 10:1 can be expected for earthworms living in DDE-contaminated soils.
- Long-term persistence of DDT and metabolites can be expected in soils and sediments.”

Several limitations were identified during the Phase 1 EcoRA including availability of current distribution and chemical characteristics of sediment and surface waters in Kenwood Drain, Torrance Lateral, Dominguez Channel, and Consolidated Slip; available information on aquatic communities in the Dominguez Channel was incomplete or old (over 15 years); and a lack of recent bioaccumulation data for Montrose-related COPECs.

Based on the conclusions and limitations of the Phase 1 EcoRA, Phase 2 ecological investigations were recommended.

Toxic Substances Monitoring Program

The Toxic Substances Monitoring Program (TSMP) was established by the California State Water Resources Control Board in 1976 to monitor potential toxicity in freshwater habitats via analysis of freshwater fish and other aquatic organisms (CSWRCB, 1996a). Chemicals routinely analyzed for include trace elements, pesticides, and polychlorinated biphenyls (PCBs). Polynuclear aromatic hydrocarbons (PAHs) are also analyzed for on an "as-needed" basis.

Data from the TSMP are available only from 1978 through 1996; data for subsequent years were not available at the time of this sampling plan. The Dominguez Channel at the Pacific Coast Highway bridge is one of the sampling locations for the TSMP but it was sampled only in 1992. White croakers (*Genyonemus lineatus*) from that station contained elevated concentrations of total DDT (6.49 ppm, wet weight) (CSWRCB, 1995, 1996a).

State Mussel Watch Program

The California State Mussel Watch Program (SMWP) was established in 1977 to monitor water quality in the state’s coastal areas (CSWRCB, 1996b). Bivalve mollusks are collected from clean areas and transplanted to each monitoring site where they are left for several months. They are then collected and analyzed for trace elements, synthetic organic pesticides, PCBs, and PAHs. California mussels (*Mytilus californianus*) are used for most coastal areas and freshwater clams (*Corbicula fluminea*) are used in estuaries where mussels do not survive due to low salinity levels.

The Consolidated Slip was the only portion of the surface water drainage pathway that has been included in the SMWP. Two locations in the Consolidated Slip, one at the upstream end by the Henry Ford Avenue bridge and one at the downstream end, were sampled as part of the program. The upstream location at the Henry Ford Avenue bridge was evaluated for DDT-related chemicals in 1982, 1986, and 1987. The downstream location in the Consolidated Slip was evaluated for DDT-related chemicals yearly from 1982 through 1996 (CSWRCB, 1996b). Total DDT levels in mussel tissues collected near the Henry Ford Bridge ranged from 48.4 to 206 ppb (wet weight). Levels in mussels collected in the downstream end of the Consolidated Slip ranged from 30.82 to 285 ppb total DDT. The

Maximum Tissue Residue Level (MRTL) for Enclosed Bays and Estuaries of for total DDT was calculated at 32 ppb wet weight. This value was exceeded at both locations for all sampling years except for the downstream end of the Consolidated Slip in 1989 (CSWRCB, 1996b).

Bay Protection and Toxic Cleanup Program

The Bay Protection and Toxic Cleanup Program (BPTCP) was established by the California State legislature in 1989 (CSWRCB et al., 1998). The primary activities of the BPTCP consist of monitoring and assessment of sediments in selected California bays and estuaries.

The Consolidated Slip was evaluated in the BPTCP studies in 1992, 1994, and 1996 (CSWRCB et al., 1998; see summary in Table 1 and Figure 8). The Dominguez Channel was evaluated in 1996. Studies conducted in Consolidated Slip and Dominguez Channel included sediment sampling to evaluate the vertical and horizontal distribution of chemicals of concern; toxicity testing with marine and estuarine amphipods red abalone, and polychaete worms in sediments and porewaters; and benthic community analyses. Sediment samples showed the greatest potential for toxicity from mercury, zinc, chlordane, PAHs, and PCBs. DDTs did not exceed Effects Range-Median (ER-M) toxicity thresholds for any of their Consolidated Slip samples collected in 1996 (surface and at depth) nor for the earlier 1992 or 1994 samples (CSWRCB et al., 1998; RWQCB, 1999). Samples have not been collected since 1996 due to lack of funding (Lyons, 2001).

Phase 2 Surface Drainage Pathway Investigation

The Phase 2 Surface Drainage Pathway Investigation was conducted as part of the RI/FS activities for the site. The ecological investigations were conducted in 1994 and focused on collection of additional information for the surface drainage pathway. The SAP (CH2M HILL, 1993) specified collection of information to further characterize the site including occurrence and distribution of accumulated sediment, current chemical concentrations in sediment and surface water, potential ecological receptors present in the drainage pathway, and potential bioaccumulation of Montrose-related chemicals in ecological receptors.

Activities included in the Phase 2 investigation included collection of sediment, surface water, and aquatic biota as well as a bird survey along the banks of the stormwater pathway. Sediment and surface water were collected in Normandie Avenue/Jones Ditch, Kenwood Drain, Torrance Lateral (lined and unlined segments), Dominguez Channel, and Consolidated Slip. Biota sampling was conducted in the lower portion of the Torrance Lateral, the Dominguez Channel, and Consolidated Slip. A reconnaissance-level bird survey was conducted along the Dominguez Channel, the outlet of the Torrance Lateral, and the upper and lower ends of the Consolidated Slip. The results of the Phase 2 field effort and deviations from the SAP were documented in the field report (CH2M HILL, 1995).

Sediment samples throughout the surface drainage pathway had detected concentrations of metals and pesticides (CH2M HILL, 1995). DDT (isomers and metabolites) and chlordane were the only chemicals detected throughout the drainage pathway. DDT (including isomers and metabolites) was detected at much higher concentrations in the Normandie Avenue/Jones Ditch and in the Kenwood Drain than in other downstream locations. The number of pesticides detected in the Consolidated Slip was also greater than in upstream areas, indicating that the slip may be serving as a sink for chemicals transported downstream during tidal movements or storm events as well as other sources discharging into Los Angeles Harbor. PAHs were also detected in Kenwood Drain, Torrance Lateral – Unlined Segment, and Consolidated Slip, but the results were validated for qualitative use only due to detection limits greater than those specified by the contract (CH2M HILL, 1995).

Surface water sampling results indicated that a limited number of metals and organics (primarily pesticides) were detected. Concentrations of metals generally decreased moving downstream from the Kenwood Drain to the Torrance Lateral and into the Dominguez Channel. Mercury concentrations remained relatively constant throughout the drainage pathway. The only organic chemicals detected in surface water were DDT (isomers and metabolites) and BHC, and they were detected only in Kenwood Drain at low concentrations (CH2M HILL, 1995).

Aquatic biota sampling results indicated that metals and a few organics were detected, but a trend in detected concentration with location in the drainage pathway could not be established based on the results. DDD, DDE, and DDT were detected in various samples collected in each part of the surface drainage pathway, but most of the results were validated for qualitative use only. Results validated for quantitative use consisted of DDE in some of the samples collected from Torrance Lateral – Lined Segment, Dominguez Channel – Segment 1, Dominguez Channel – Intersection with Torrance Lateral, and the Consolidated Slip. The two locations with the largest number of detected chemicals (validated for either quantitative or qualitative use) were the Dominguez Channel – Intersection with the Torrance Lateral and the Consolidated Slip (CH2M HILL, 1995).

2.3 Recent Sediment Maintenance and Characterization Activities

CH2M HILL contacted Los Angeles officials to determine if maintenance activities related to sediments in the surface water drainage pathway had occurred since the 1994 CH2M HILL sampling event. There was no evidence of agency attempts at recent characterizations of DDT in sediment within the system since the 1996 sampling for the BPTCP (described above), which was limited to Consolidated Slip. Nevertheless, it remains possible that periodic high flows since 1994 have affected sediment distribution and sediment quality in the drainage system (CH2M HILL, 2001).

The Los Angeles County Department of Public Works (LACDPW) does not have any routine sediment clearing schedule for the upper drainages (Kenwood Drain, Torrance Lateral, or Dominguez Channel), and there was no evidence of LACDPW sediment clearance activities for those areas. The LACDPW only retains records for the last two years, and did not have any other maintenance records. They were unaware of any channel clearing activities in the drains of interest (CH2M HILL, 2001).

Previous data collection had indicated that the Torrance Lateral, from Western Avenue to the Dominguez Channel was possibly scraped (i.e., invert scraping) by the LACDPW, in the spring of odd-numbered years. It is unknown when the last scraping occurred. Records show that the Torrance Lateral was not scraped in 1993 due to the heavy winter rains of 1992-1993 which scoured the lateral, but loose debris was collected (Nakahara, 1993). Sediments and debris removed from the lateral were not chemically analyzed, but were transferred to a landfill (Nakahara, 1992).

Carl Ripaldi/Alameda Corridor has been required to evaluate the water quality of their dewatering discharge for metals only (no DDT determinations). In addition, they characterized the attached invertebrate community (mussel beds) and bioaccumulation of metals in mussels in the Dominguez Channel. Mr. Ripaldi indicated that since the 1997-1998 El Nino flooding there are abundant mussel beds in the channel (as CH2M HILL found in 1994). He has no information on the extent of sediment accumulation or of sediment or invertebrate concentrations of compounds other than metals (CH2M HILL, 2001).

The Consolidated Slip has not been dredged in recent history, in large part due to the designation of the Superfund status for the Montrose drainage pathways. The Los Angeles Regional Water Quality Control Board (LARWQCB) and the Port of Los Angeles have indicated the need to eventually clear sediments from the area. A recent consent decree has generated funds that are set aside for dredging, with an initial $400,000 set aside to begin the process. The Port of Los Angeles will encourage USEPA involvement in harbor dredging versus expenditures on any possible upstream remediation (CH2M HILL, 2001).

3.0 Proposed Sampling and Analyses

As stated previously, the focus of the sampling effort is to verify results of the 1994 sampling, collect information on current sediment distribution and concentrations of DDT-related chemicals, and to gather additional information on site-related vs. non-site-related concentrations of DDT-related chemicals. The overall goal is to evaluate the amount of sediment present in the surface water drainage pathway and the concentration of Montrose-related chemicals (DDT isomers and metabolites) that might be mobilized and transported to downstream areas.

The sampling effort will consist of two phases: (1) survey of existing sediment deposits, and (2) collection of sediment samples. The sediment survey will be conducted to estimate location, size, and depth of existing sediment deposits and to assist in the determination of sediment sampling locations. Sediments will then be collected and submitted for chemical analyses.

The proposed sampling and analyses will focus on those areas within the surface water drainage pathway that were sampled by CH2M HILL in 1994 with the following three modifications:

- The Upper Dominguez Channel will be added to the sampling effort to verify that there are not other upstream sources of DDT.
- The upper portion of the Kenwood Drain from 204th Street to Del Amo Boulevard and the Torrance Lateral above the confluence with Kenwood Drain will be added to the sampling effort to similarly verify that there are not other upstream sources of DDT that enter the storm drain.

The drainages to be sampled include Normandie Avenue/Jones Ditch, Kenwood Drain, Torrance Lateral – Lined Segment, Torrance Lateral – Unlined Segment, Torrance Lateral above Kenwood Drain, Upper Dominguez Channel, Dominguez Channel (including 4 segments and the intersection of the Torrance Lateral with the channel), and the Consolidated Slip.

The methods used for conducting the sediment survey and collection of the sediment samples are described below in Section 3.1 Field Sampling Procedures. The analytical procedures are presented in Section 3.2 Analytical Procedures. A summary of the specific survey, sampling, and analytical procedures for each drainage is presented in Section 3.3 Drainage Sampling and Analysis Plans and in Table 2.

3.1 Field Sampling Procedures

Field sampling procedures will include a sediment survey and sediment sample collection. The methods used for each will depend on the physical characteristics of the individual drainages.

Sediment Survey

The sediment survey will be conducted to identify the location as well as the approximate depth and dimensions of the sediment deposits. It will also be used to determine the locations for sample collection. Normandie Avenue/Jones Ditch, the Torrance Lateral (including lined unlined, and uppermost segments), and the Upper Dominguez Channel typically contain little or no water. For these drainages, the sediment survey will be conducted on foot while walking the drainage. Sediment deposits found will be measured and mapped. The width of the sediments will be determined using a measuring tape and depth will be determined using a stainless steel ruler or measuring stick. Based on these measurements, the volume can also be estimated. After mapping all the deposits in the drainage, the preferred method to select the sampling locations can be identified (using methods discussed below).

The Kenwood Drain is an underground system accessed via manholes. For this drainage, the sediment survey will be conducted by inspecting the drain at each manhole for potential sediments. The presence or absence of sediment will be noted and sediment depth will be measured using a stainless steel ruler.

The Dominguez Channel (Segments 1, 2, 3, and 4; and the mid-channel locations at the intersection with the Torrance Lateral) are accessible only by boat. The sediment survey for this channel will be conducted using a continuous fathometer and global positioning system (GPS) to determine sediment deposits/depths and locations along each drainage. The results of the survey will be used to map the sediment deposits and determine the sampling locations.

Consolidated Slip locations are also accessible only by boat. Sediment sampling locations in the Consolidated Slip will be confirmed with GPS but sediments will not be surveyed for sediment thickness.

Sediment Sampling

It is estimated that about 97 sediment samples will be collected throughout the surface water drainage pathway (Table 2). Samples collected using stainless steel trowels will be collected from 0 to 6 inches into the sediment deposit. Samples from the vibracores will be taken from two intervals at Dominguez Channel locations: 1) the 0-to-6-inch interval, and 2) a composite of the remainder of the core down to the channel liner. Vibracore samples in the Consolidated Slip will be collected to a depth of 6 feet. Three samples will be collected from each core and will consist of a 0–to-6 inch sample, a 6 inch–to-3 foot depth, and a 3 foot-to-6 foot sample at each location. The top 6-inch interval will be composited; adequate material will be taken for analysis and the remainder of this material (if any) will be frozen and archived. The remainder of the core will be divided into the 6-inch to 3-foot and 3- to 6-foot segments. If the consistency of the sediment allows, the core will be split longitudinally; samples will be taken from one half of each segment, and the other half will be archived (frozen). If the material is too soft to retain its shape when extruded from the vibracore tube, a representative sample will be taken from each segment for analysis and the remainder of each will be archived. Attempting to save these cores in this manner will present some logistical challenges, and storing 3-foot core segments in a freezer may prove costly. In addition, if the sediment is too soft, it will not retain its form and will be difficult to collect samples later from known, discrete intervals.

Quality control samples will include field duplicates, matrix spike/matrix spike duplicates (MS/MSD), and equipment rinseates. The field duplicates will be collected at a frequency of 1 per drainage with the exception of the Dominguez Channel for which all segments will be considered together and 1 field duplicate will be collected per 10 samples. MS/MSDs will be collected at a frequency of 1 per 20 samples or 1 per sample delivery group (SDG) to the laboratory. Equipment rinseates will be collected at a frequency of 1 per piece of equipment per 20 samples.

It is assumed that sediment deposits will be found in each portion of the drainage pathway, and that sediment volumes will be sufficient to warrant characterization of the sediment. It is also assumed that sediment deposits in the Dominguez Channel will be more than 6 inches deep, and that two samples per location should be analyzed. If some of those assumptions prove to be incorrect, the number of samples to be analyzed would be fewer than listed below and in Table 1. In summary, the proposed sampling includes 5 samples in potentially affected portions of each of the following: Normandie Avenue/Jones Ditch, Kenwood Drain, Torrance Lateral – Lined segment, and Torrance Lateral – Unlined segment. Two samples would be collected in each of the following upstream (unaffected by Montrose site) drainages: Torrance Lateral above Kenwood Drain, Kenwood Drain, and the Upper Dominguez Channel. Ten samples (two from each vibracore) would be collected from each of five segments of the tidally influenced portion of the Dominguez Channel, and 6 samples would be collected along the intertidal zone of Dominguez Channel banks at the intersection of the Torrance Lateral and the channel. Three samples representing sequential depth ranges will be collected from each of five sites in the Consolidated Slip (15 samples total). The collection of at least 5 samples at a given depth in each drainage allows for the calculation of summary statistics including 95th upper confidence levels.

The sample locations will be determined using the results of the sediment survey for each drainage and either focusing on apparent areas of sediment deposition (especially in the flooded portions of the Dominguez Channel) or a randomized, distributional system to assure that the drainage pathway is adequately characterized. The previous survey of bottom elevation of the Dominguez Channel (CH2M HILL, 1995) indicated irregularly-spaced patterns of shallow or deeper water independent of the expected gradual longitudinal slope of the channel bottom. Any shallower areas discovered in the current survey will be assumed to be areas of relatively greater sediment deposition and will be targeted for sediment sampling. For the intertidal zone at the intersection of the Torrance

Lateral and the Dominguez Channel, 3 samples will be collected from each bank at equispaced locations unless obvious areas of sediment accumulation are found. The Consolidated Slip will be divided into 5 equal parts and sampled using a stratified random sampling method.

3.2 Analytical Procedures

Review of previous ecological studies (Section 2.2) indicated that metals, organochlorine pesticides, and other organic chemicals are present in sediments of the surface water drainage pathway. However, sediment results from the 1994 sampling event indicated that the only organochlorine pesticides found in the drainages immediately downstream from the Montrose site (Normadie Avenue Ditch and Kenwood Drain) were the DDT-related products (CH2M HILL, 1995). Other chemicals were found sporadically in the surface water drainage pathway, but were not found immediately downstream indicating other potential sources. Therefore, the analyses for this sampling event will consist of DDT-related chemicals (2,4’-DDD; 2,4’-DDE; 2,4’-DDT; 4,4’-DDD; 4,4’-DDE; and 4,4’-DDT) and total organic carbon (TOC).

3.3 Drainage Sampling and Analysis Plans

The drainages to be included in this sampling event are summarized below and in Table 1.

Normandie Avenue Ditch/Jones Ditch

This drainage runs along the east side of the Montrose property and enters a catchbasin for the Kenwood Drain (Figure 4). The sediment survey for this segment will be conducted on foot using manual measurements. It is expected that this segment will be sampled by dividing it into 5 intervals and collecting 1 sample per interval. The samples collected from this segment will be used to verify results obtained during the 1994 sampling and to characterize current conditions.

Kenwood Drain

The Kenwood Drain will be divided into an upstream and downstream portion based on the location of the catchbasin from the Normandie Avenue Ditch. The upstream portion lies between 204th Street and Del Amo Boulevard, and the downstream portion lies between the catchbasin that receives runoff from the Normandie Avenue/Jones Ditch (at Kenwood Avenue and 204th Street) and the outlet into the Torrance Lateral at New Hampshire Avenue between 209th Street and 210th Street (Figures 4 and 5). Because this drain is underground, the sediment survey will be conducted by manually inspecting the drain at each manhole. Many manholes showed no sediments present during the 1994 sampling event (CH2M HILL, 1995), so only those manholes that have sufficient volumes of sediment will be sampled. If sufficient sediment volumes are present, then 2 samples will be collected in the upstream portion and 5 samples will be collected in the downstream portion of this drain. The samples collected from this segment will be used to verify results obtained during the 1994 sampling and to characterize current conditions.

Torrance Lateral – Upper Segment

This lined segment of the Torrance Lateral runs upstream from the confluence with the Kenwood Drain (Figure 6). The sediment survey will be conducted on foot using manual measurements. If similar conditions exist as during the 1994 sampling event, it is expected that sediment deposits will be scattered along this segment, with more accumulation in downstream portions. If possible, the segment will be divided into 2 intervals and 1 sample collected per interval. If deposits are found in only one portion of the segment, then the portion of the segment containing deposits will be divided into 2 intervals for sampling. The samples collected from this segment will be used to characterize current conditions in the local drainage system separate and upstream from the Montrose influence.

Torrance Lateral – Lined Segment

The lined segment of the Torrance Lateral runs from the outlet of the Kenwood Drain to near the upstream (west) side of the San Diego Freeway (I-405) (Figure 6). The sediment survey will be conducted on foot using manual measurements. If similar conditions exist as during the 1994 sampling event, it is expected that sediment deposits will be scattered along this segment, with more accumulation in downstream portions. If possible, the segment will be divided into 5 intervals and 1 sample collected per interval. If deposits are found in only one portion of the segment, then the portion of the segment containing deposits will be divided into 5 intervals for sampling. The samples collected from this segment will be used to verify results obtained during the 1994 sampling and to characterize current conditions.

Torrance Lateral – Unlined Segment

The unlined segment of the Torrance Lateral begins at the west side of the San Diego Freeway (I-405) and runs to the confluence with the Dominguez Channel (Figure 6). The sediment survey will be conducted on foot using manual measurements. If similar conditions exist as during the 1994 sampling event, it is expected that sediment deposits will be scattered within this segment. If possible, the segment will be divided into 5 intervals and 1 sample collected per interval. If deposits are found in only one portion of the segment, then the portion of the segment containing deposits will be divided into 5 intervals for sampling. The samples collected from this segment will be used to verify results obtained during the 1994 sampling and to characterize current conditions.

Upper Dominguez Channel

The Upper Dominguez Channel from Western Avenue to the northern point of tidal influence (approximately at Vermont Avenue) will be surveyed and sampled if sediment is present (Figure 7). This segment was not sampled during the 1994 sampling event. It is being added to the sampling plan to further identify site- vs. non-site-related contamination because it would not be impacted by runoff from the Montrose site. The sediment survey will be conducted on foot using manual measurements. If sediment deposits are present, the 2 samples will be collected beginning just above the northern point of tidal influence and extending upstream.

Dominguez Channel – Segment 1

Segment 1 of the Dominguez Channel extends from the northern end of tidal influence at Vermont Avenue to approximately 500 feet upstream of the confluence with the Torrance Lateral (Figure 7). The sediment survey for this segment will be conducted by boat using a continuous fathometer and GPS. The results of the survey will determine the method for selecting sampling locations. The 5 locations with the greatest apparent amount of accumulated sediment will be sampled (one core per deposit). If sediment deposits appear to be uniform, the segment will be divided into 5 intervals and 1 sample location will be established per interval beginning at a randomly selected location and placing each subsequent sample location equidistant from the previous one. Samples will be collected using a boat-mounted vibracore. Two samples will be collected from each vibracore, one at the 0-6 inch depth and a composite of the remainder of the core. The samples collected from this segment will be used to verify results obtained during the 1994 sampling and to characterize current conditions.

Dominguez Channel – Intersection with Torrance Lateral

The Intersection of the Torrance Lateral and the Dominguez Channel extends about 500 feet upstream and 500 feet downstream of the confluence (Figure 7). This segment will be sampled at both mid-channel and along the intertidal zone of the channel bank.

The mid-channel sediment survey will be conducted by boat using a continuous fathometer and GPS. The 5 locations with the greatest apparent amount of accumulated sediment will be sampled (one core per deposit). If sediment deposits appear to be uniform, the segment will be divided into 5 intervals and 1 sample location will be established per interval beginning at a randomly selected location and placing each subsequent sample location equidistant from the previous one. The samples will be collected using a boat mounted vibracore with two samples collected per core (0-6 inches and the remainder of the core).

The intertidal zone will be surveyed by foot and 3 equidistant locations will be selected on each bank for sampling. The samples collected from this segment will be used to verify results obtained during the 1994 sampling and to characterize current conditions.

Dominguez Channel – Segment 2

Segment 2 of the Dominguez Channel extends from approximately 500 feet downstream of the confluence with the Torrance Lateral to the San Diego Freeway overpass (Figure 7). The sediment survey for this segment will be conducted by boat using a continuous fathometer and GPS. The results of the survey will determine the method for selecting sampling locations. The 5 locations with the greatest apparent amount of accumulated sediment will be sampled (one core per deposit). If sediment deposits appear to be uniform, the segment will be divided into 5 intervals and 1 sample location will be established per interval beginning at a randomly selected location and placing each subsequent sample location equidistant from the previous one. Samples will be collected using a boat-mounted vibracore. Two samples will be collected from each vibracore, one at the 0-6 inch depth and a composite of the remainder of the core. The samples collected from this segment will be used to verify results obtained during the 1994 sampling and to characterize current conditions.

Dominguez Channel – Segment 3

Segment 3 of the Dominguez Channel extends from the overpass for the San Diego Freeway to the overpass for Sepulveda Boulevard (Figure 7). The sediment survey for this segment will be conducted by boat using a continuous fathometer and GPS. The results of the survey will determine the method for selecting sampling locations. The 5 locations with the greatest apparent amount of accumulated sediment will be sampled (one core per deposit).

If sediment deposits appear to be uniform, the segment will be divided into 5 intervals and 1 sample location will be established per interval beginning at a randomly selected location and placing each subsequent sample location equidistant from the previous one. Samples will be collected using a boat-mounted vibracore. Two samples will be collected from each vibracore, one at the 0-6 inch depth and a composite of the remainder of the core. The samples collected from this segment will be used to verify results obtained during the 1994 sampling and to characterize current conditions.

Dominguez Channel – Segment 4

Segment 4 of the Dominguez Channel extends from the overpass at Sepulveda Boulevard downstream to the uppermost portion of the Consolidated Slip at the Henry Ford Avenue bridge (Figure 7). The sediment survey for this segment will be conducted by boat using a continuous fathometer and GPS. The results of the survey will determine the method for selecting sampling locations. The 5 locations with the greatest apparent amount of accumulated sediment will be sampled (one core per deposit). If sediment deposits appear to be uniform, the segment will be divided into 5 intervals and 1 sample location will be established per interval beginning at a randomly selected location and placing each subsequent sample location equidistant from the previous one. Samples will be collected using a boat-mounted vibracore. Two samples will be collected from each vibracore, one at the 0-6 inch depth and a composite of the remainder of the core. The samples collected from this segment will be used to verify results obtained during the 1994 sampling and to characterize current conditions.

Consolidated Slip

The Consolidated Slip begins at the downstream end of the Dominguez Channel at the Henry Ford Avenue bridge (Figure 7) and connects to upper Los Angeles Harbor. Five sampling locations in the Consolidated Slip will be selected using a stratified random design. The Consolidated Slip will be divided into five "zones" between the mouth of the Dominguez Channel and the narrower "downstream" portion of the Consolidated Slip. The "zones" will be established as roughly equal-sized areas by drawing lines across the Consolidated Slip; one randomly selected location will be identified within each of these zones. Samples will be collected to a depth of 6 feet using a boat-mounted vibracore. Three samples will be collected from each vibracore; one at the 0-6 inch depth, one at the 6 inch to 3 foot depth, and one at 3 feet to 6 foot depth. The samples collected from this segment will be used to verify results obtained during the 1994 sampling and to characterize current conditions.

4.0 References

California State Water Resources Control Board (CSWRCB). 1995. Toxic Substances Monitoring Program 1992-93 Data Report. 95-1WQ. State Water Resources Control Board, California Environmental Protection Agency.

California State Water Resources Control Board (CSWRCB). 1996a. Toxic Substances Monitoring Program 1994-1995 Data Report (yearly sampling summary tables and online database http://www.swrcb.ca.gov). California Environmental Protection Agency.

California State Water Resources Control Board (CSWRCB). 1996b. State Mussel Watch Program 1993-1995 Data Report (and online database http://www.swrcb.ca.gov). California Environmental Protection Agency.

California State Water Resources Control Board (CSWRCB), California Regional Water Quality Control Board – Los Angeles Region, California Department of Fish and Game, University of California – Santa Cruz, and San Jose State University. 1998. Sediment Chemistry, Toxicity, and Benthic Community Conditions in Selected Water Bodies of the Los Angeles Region. Final Report. August.

CH2M HILL. 1992. Draft Ecological Risk Assessment, Montrose Chemical Corporation. October.

CH2M HILL. 1993. Sampling and Analysis Plan for Sediment, Surface Water, and Biological Sampling. Montrose Superfund Site. Los Angeles, California. June.

CH2M HILL. 1995. Field Report – Surface Water, Sediments, and Biological Sampling in Stormwater Pathway from Montrose Chemical Company to Los Angeles Harbor. July.

CH2M HILL. 2001. Memorandum – Recent Sediment maintenance and Characterization Activities Along the Montrose Surface Water Pathways. May 7.

Hargis & Associates. 1990. Preliminary Draft Remedial Investigation, Montrose Site, Torrance, CA. April.

Los Angeles County Department of Public Works (LACDPW). 1991. Drains and Facilities. Los Angeles County, Thomas Guide. Thomas Brothers Maps. Irvine, California.

Lyons, M. 2001. Personal communication with Trudy Pulley/CH2M HILL. June 13.

Nakahara. 1992. Personal communication from Eiji Nakahara. Department of Public Works, Los Angeles County to Susan Keydel/CH2M HILL. July 1.

Nakahara. 1993. Personal communication from Eiji Nakahara. Department of Public Works, Los Angeles County to Susan Keydel/CH2M HILL. May 4.

Regional Water Quality Control Board (RWQCB). 1999. Regional Toxic Hot Spot Cleanup Plan. Los Angeles Region. May.

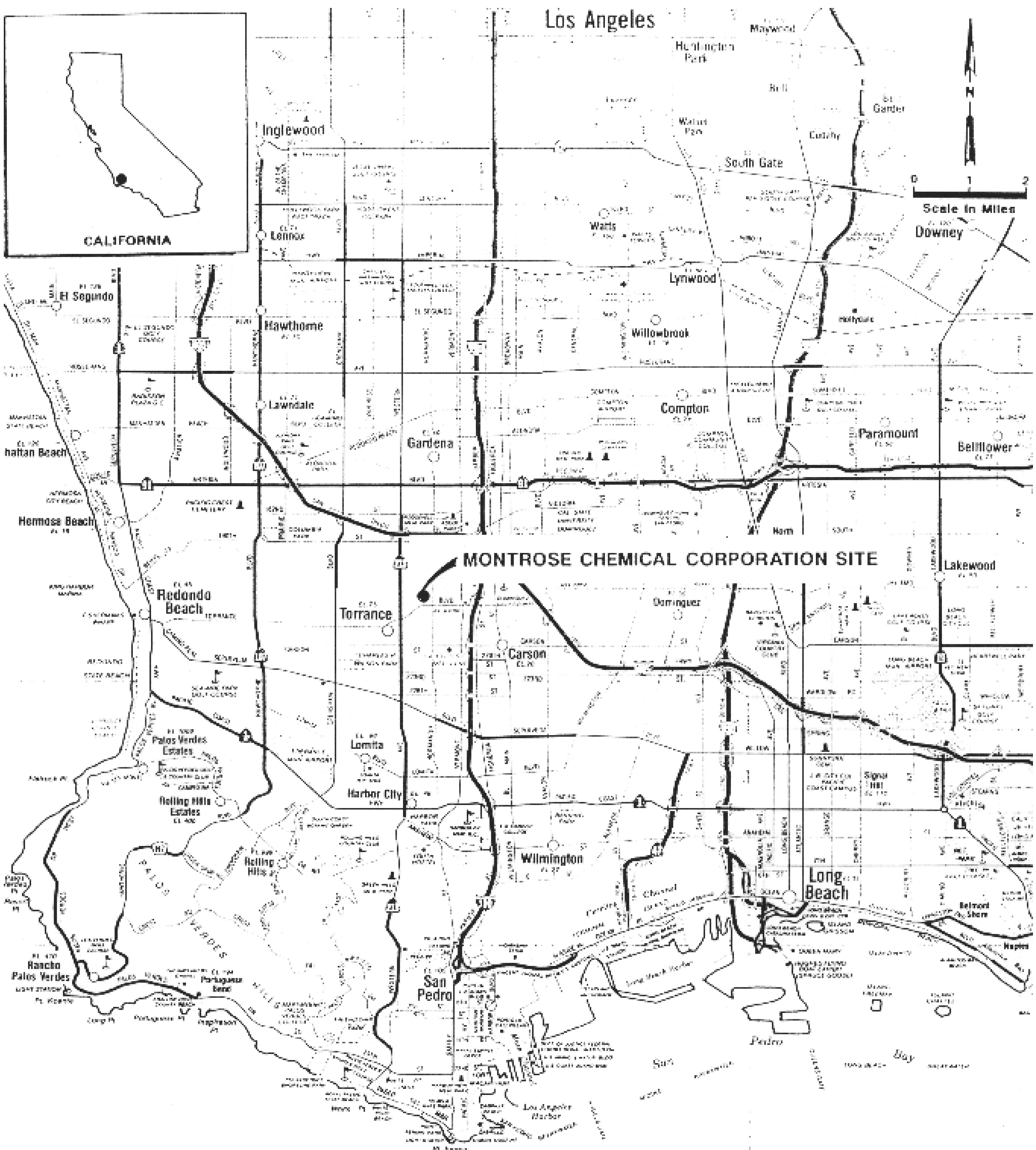


Figure 1
Regional Site Map

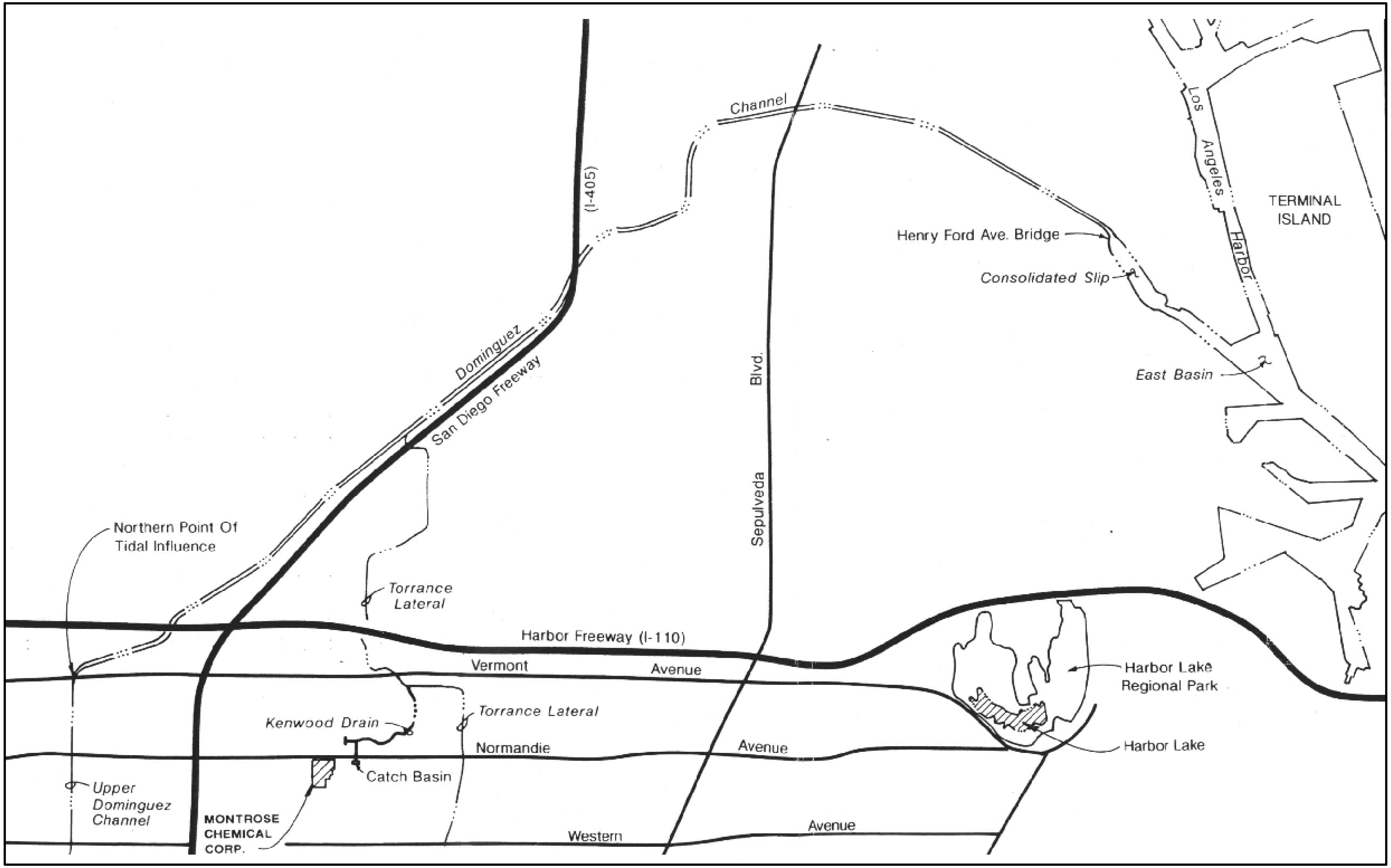


Figure 2
Surface Water Drainage Pathways

CH2MHILL

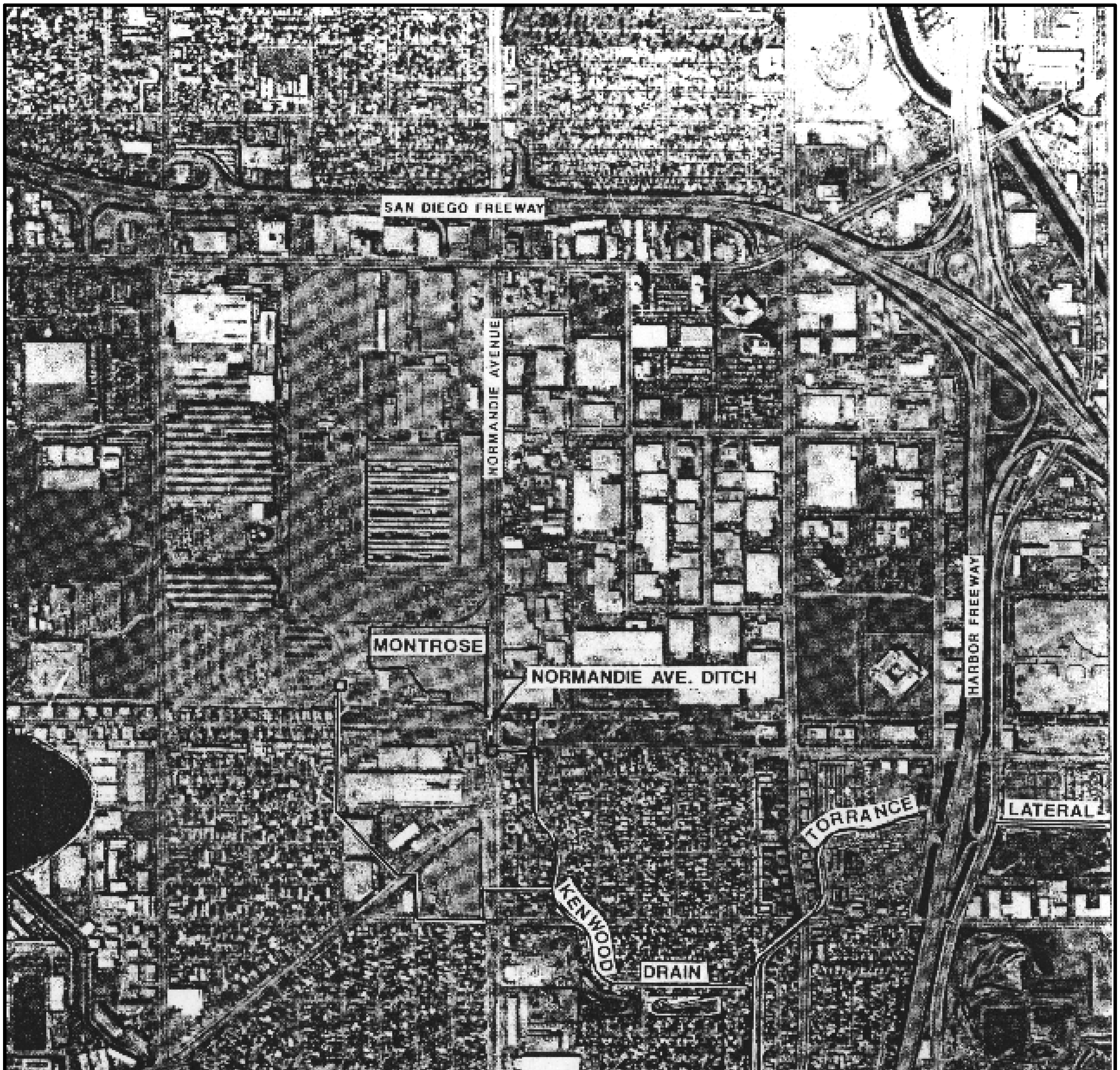


Figure 3
Surface Water Drainage Pathways in the Montrose Area

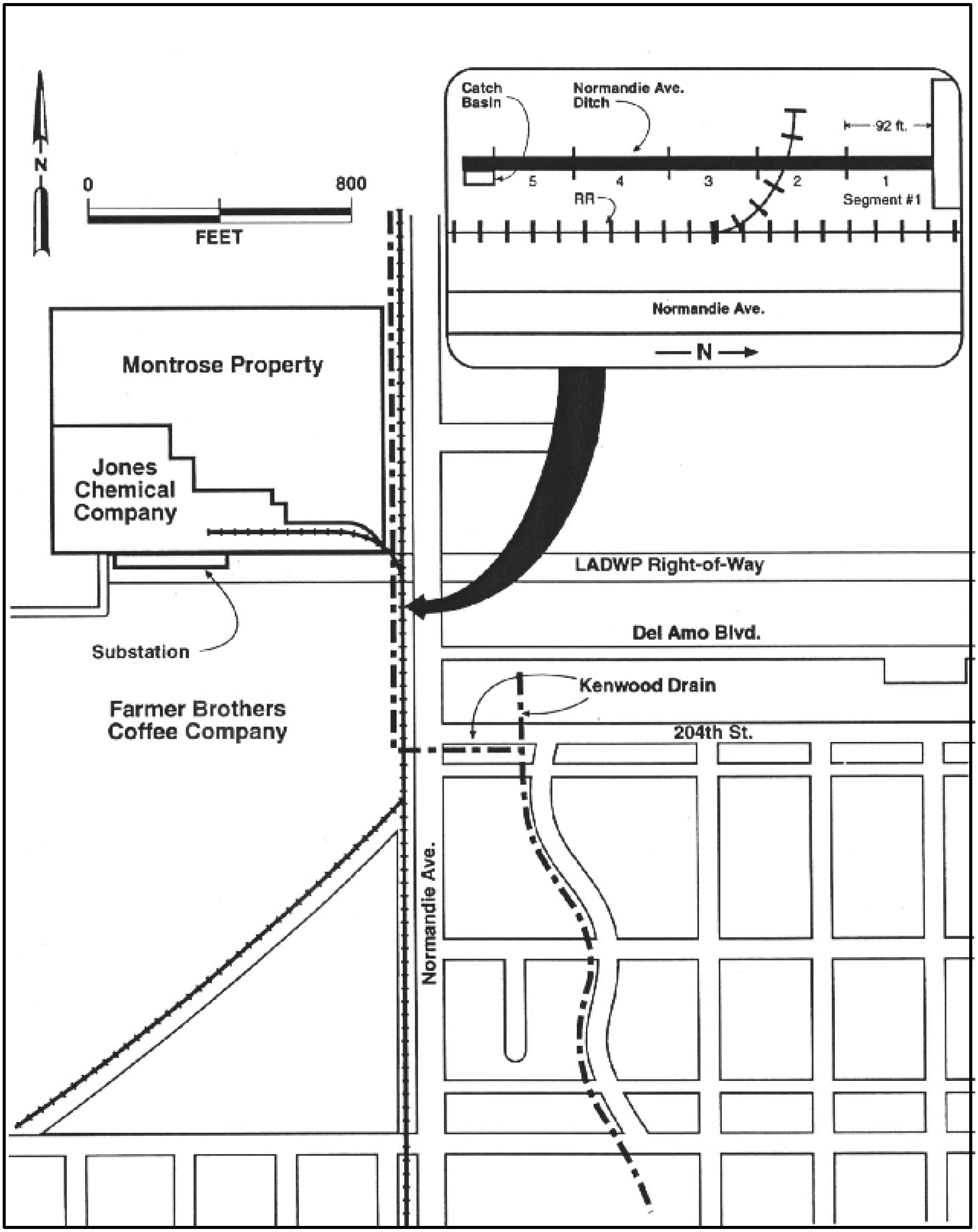
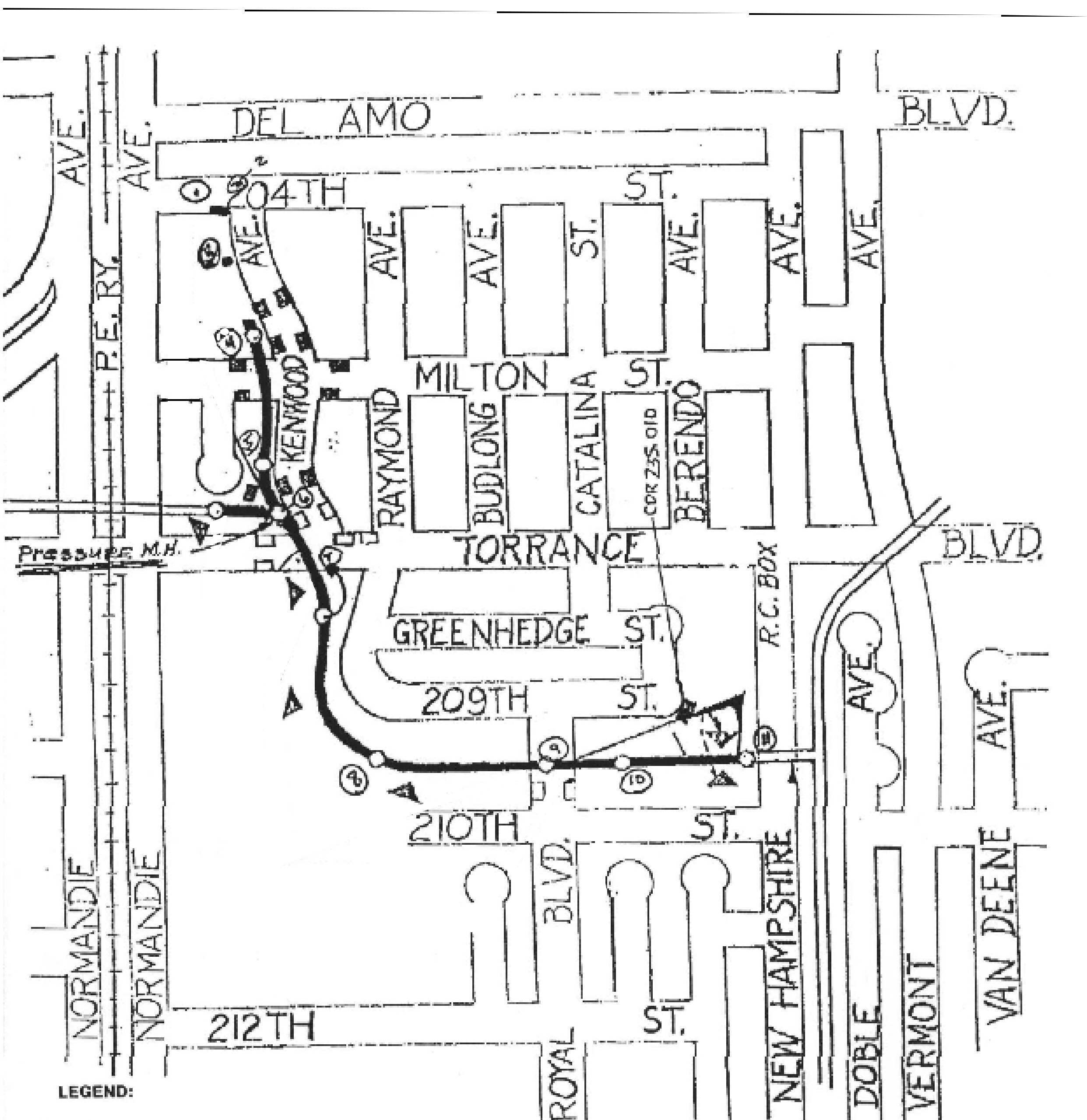


Figure 4
Sediment Sampling Segments for the Normadie Avenue Ditch

CH2MHILL



LEGEND:

- Manhole
- Manhole number referred to in text
- Subsurface drain maintained by F.C.D.
- Open surface drain maintained by F.C.D.
- Catch basin maintained by F.C.D.
- Catch basin
- Inlet

Figure 5
Sediment Sampling Locations/Manholes for the Kenwood Drain

CH2MHILL

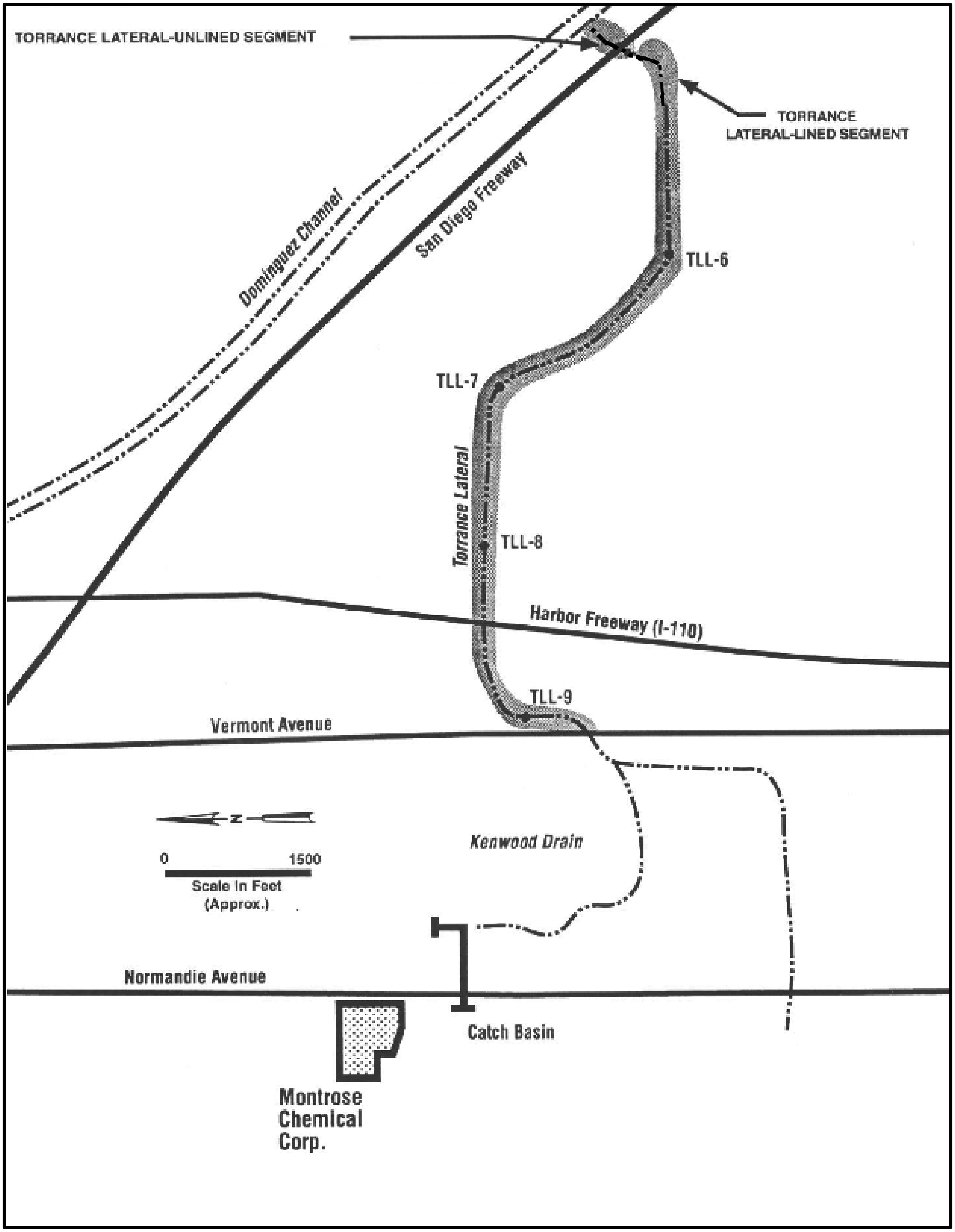


Figure 6
Sediment Sampling Segments for the Torrance Lateral

CH2MHILL

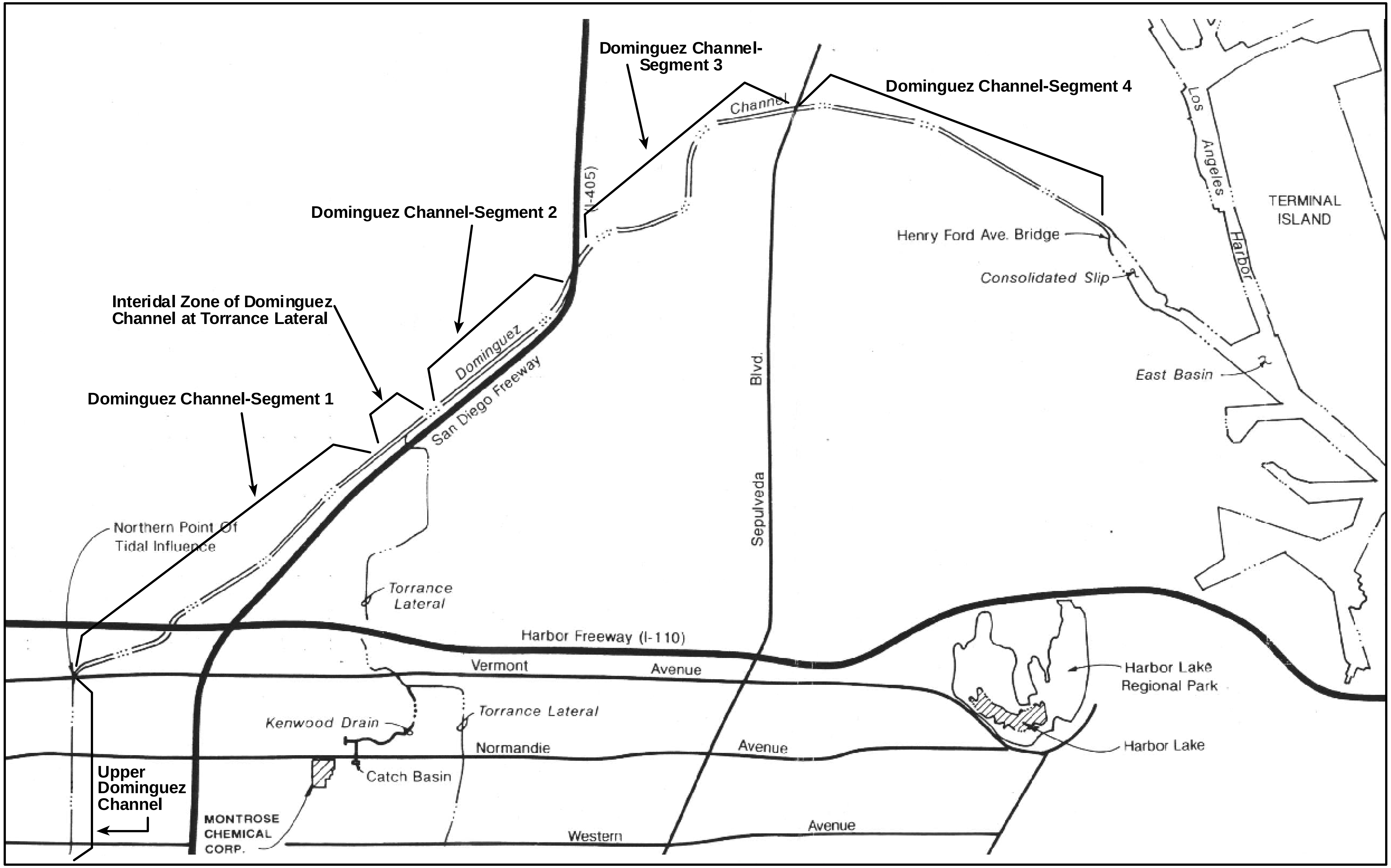


Figure 7
Sediment Sampling Segments for the Dominguez Channel

CH2MHILL

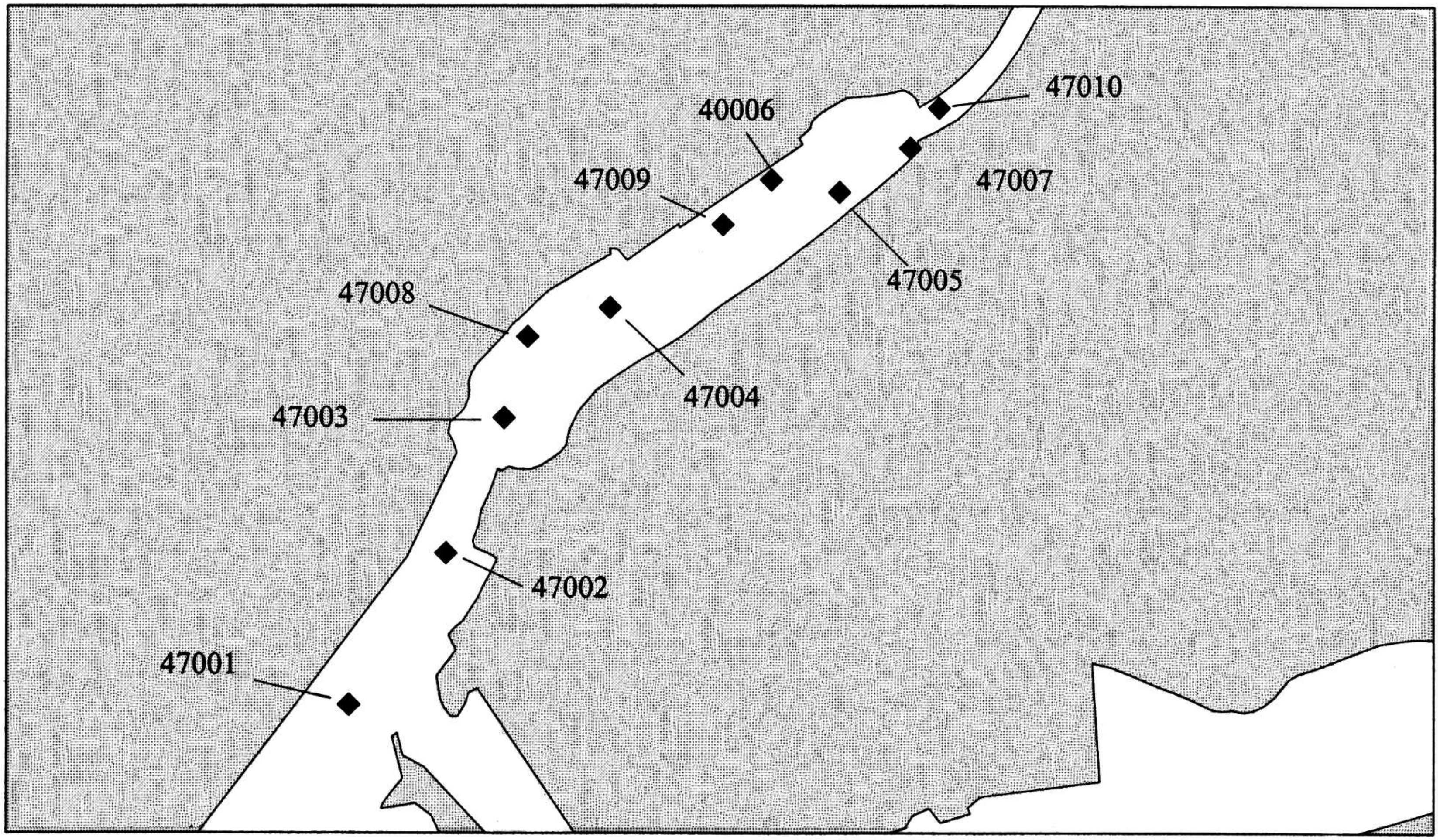


Figure 8
Bay Protection and Toxic Cleanup Program
Consolidated Slip Sampling Stations

Table 1. Summary of Analytical Results for Samples Collected from the Consolidated Slip

	BPTCP[a] 7/31/92				BPTCP[a] 02/01/1994				BPTCP[a] 07/17/1996 - 07/18/1996				BPTCP[a] 07/17/1996 Depth from 30cm to 90cm				BPTCP[a] 07/17/1996 Depth from 90 cm to 150 cm	BPTCP[a] 07/18/1996 Storm Drain	BPTCP[a] 07/18/1996 End Surface	CH2M HILL 4/12/1994			
ANALYTES[b]	NO. ANALYZED	NO. DETECTS	MAX	ARITHMETIC MEAN	NO. ANALYZED	NO. DETECTS	MAX	ARITHMETIC MEAN	NO. ANALYZED	NO. DETECTS	MAX	ARITHMETIC MEAN	NO. ANALYZED	NO. DETECTS	MAX	ARITHMETIC MEAN	ANALYTICAL RESULTS	ANALYTICAL RESULTS	ANALYTICAL RESULTS	NO. ANALYZED	NO. DETECTS	MAX	ARITHMETIC MEAN
Pesticides (ug/kg)																							
Aldrin	2	0	--	--	3	0	--	--	4	3	1.84	1.47	3	0	--	--	ND	ND	ND	6	1	5.00	5.00
cis-Chlordane	2	2	26	24.5	3	3	29.9	21.7	3	3	15.6	13.1	1	1	59.5	59.5	ND	15.1	11.6	NA	NA	NA	NA
trans-Chlordane	NA	NA	NA	NA	3	3	36.7	26.8	3	3	15.6	14.1	1	1	59.5	59.5	ND	15.1	11.6	NA	NA	NA	NA
alpha-Chlordene	NA	NA	NA	NA	3	3	3.54	3.25	4	4	5.60	2.99	3	3	25.9	13.8	1.23	4.46	2.90	NA	NA	NA	NA
gamma-Chlordene	NA	NA	NA	NA	3	3	3.00	2.61	4	3	3.47	1.67	3	2	7.01	5.56	ND	2.38	1.86	NA	NA	NA	NA
Chlorpyrifos	NA	NA	NA	NA	3	3	18.9	9.90	3	3	35.1	27.5	1	1	6.49	6.49	5.65	20.7	14.2	NA	NA	NA	NA
Dacthal	NA	NA	NA	NA	3	3	1.41	1.16	3	1	0.619	0.619	1	0	--	--	ND	ND	ND	NA	NA	NA	NA
2,4'-DDD	2	2	35	34.0	3	3	35.9	33.0	3	3	33.7	27	1	0	132	132	5.08	31.4	20.6	6	5	120	45.8
4,4'-DDD	2	2	140	140	3	3	164	140	3	3	299	213	1	0	695	695	3.19	99.4	81.9	6	6	330	103
2,4'-DDE	2	2	12	11.0	3	3	11.4	9.86	4	4	8.80	5.8	3	3	48.3	28.3	ND	9.44	5.70	6	3	41.0	18.3
4,4'-DDE	2	2	270	270	3	3	360	266	4	4	290	201	3	3	380	259	3.24	178	115	6	6	260	101
4,4'-DDMS	NA	NA	NA	NA	3	1	8.41	8.41	3	3	132	72.5	1	1	268	268	20.6	20.1	13.3	NA	NA	NA	NA
4,4'-DDMU	NA	NA	NA	NA	3	3	40.9	28.3	3	3	32.7	20	1	1	126	126	ND	16.2	15.8	NA	NA	NA	NA
2,4'-DDT	2	2	9.7	8.60	3	3	6.46	4.98	4	4	2.81	2.58	3	3	4.57	3.03	2.98	4.41	3.00	6	2	92.0	48.000
4,4'-DDT	2	2	52	44.0	3	3	34.4	29.4	3	3	435	156	1	1	57.3	57.3	60.2	32.8	9.83	6	6	68.0	31.000
4,4'-Dichlorobenzophenone	NA	NA	NA	NA	3	0	--	--	3	3	22.1	14.5	1	1	63.3	63.3	ND	10.5	3.98	NA	NA	NA	NA
Dieldrin	2	2	7.1	6.65	3	3	5.36	3.00	3	3	14.1	10.4	1	1	33.3	33.3	ND	6.31	4.16	6	3	12.0	9.67
Endosulfan I	2	0	--	--	3	0	--	--	3	2	2.69	2.68	1	0	--	--	ND	ND	ND	6	1	5.00	5.00
Endosulfan II	2	0	--	--	3	0	--	--	3	1	3.16	3.16	1	0	--	--	ND	ND	ND	6	2	21.0	13.0
Endosulfan sulfate	2	0	--	--	3	1	2.67	2.67	3	0	NA	NA	1	0	--	--	2.55	ND	ND	NA	NA	NA	NA
Endrin	2	0	--	--	3	0	--	--	3	0	NA	NA	1	0	--	--	8.75	ND	ND	6	2	6.00	5.00
alpha-HCH	NA	NA	NA	NA	3	1	0.437	0.437	3	0	NA	NA	1	0	--	--	ND	1.50	ND	NA	NA	NA	NA
beta-HCH	NA	NA	NA	NA	3	1	3.47	3.47	3	0	NA	NA	1	0	--	--	ND	1.50	ND	NA	NA	NA	NA
gamma-HCH	2	0	--	--	3	0	--	--	3	0	NA	NA	1	0	--	--	1.33	ND	ND	NA	NA	NA	NA
delta-HCH	NA	NA	NA	NA	3	0	--	--	3	2	4.31	3.92	1	1	4.30	4.30	ND	ND	ND	NA	NA	NA	NA
Heptachlor	2	2	2.8	2.35	3	0	--	--	4	3	15.8	5.85	3	2	12.8	10.1	4.90	0.918	ND	6	1	12.0	12.0
Heptachlor epoxide	2	0	--	--	3	3	1.10	0.866	3	0	NA	NA	1	1	0.849	0.849	ND	ND	ND	NA	NA	NA	NA
Hexachlorobenzene	2	2	1.6	1.60	3	3	2.19	1.68	4	4	7.01	3.30	3	3	7.07	3.65	0.857	2.36	1.32	NA	NA	NA	NA
Methoxychlor	2	0	--	--	3	2	6.65	5.31	3	2	83.5	76.5	1	0	--	--	71.6	0.732	ND	NA	NA	NA	NA
Mirex	2	0	--	--	3	0	--	--	4	1	0.514	0.514	3	3	2.00	1.30	ND	0.732	ND	NA	NA	NA	NA
cis-Nonachlor	NA	NA	NA	NA	3	3	22.2	16.1	3	3	9.67	7.72	1	1	25.5	25.5	ND	7.42	4.18	NA	NA	NA	NA
trans-Nonachlor	2	2	24	23.5	3	3	34.2	24.0	3	3	12.6	10.6	1	1	47.0	47.0	ND	15.6	11.9	NA	NA	NA	NA
Oxadiazon	NA	NA	NA	NA	3	0	--	--	3	3	45.8	36.9	1	0	--	--	ND	18.5	9.34	NA	NA	NA	NA
Oxychlordane	NA	NA	NA	NA	3	3	1.67	1.31	3	3	11.9	10.2	1	1	30.3	30.3	10.7	0.997	0.703	NA	NA	NA	NA
delta-BHC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6	4	7.00	5.00
alpha-BHC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6	1	7.00	7.00
alpha-Chlordane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6	6	190	39.0
Endrin aldehyde	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6	4	10.0	8.00
Endrin ketone	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6	4	11.0	11.0
gamma-BHC (Lindane)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6	4	7.00	6.00
gamma-Chlordane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6	5	180	42.6
PCB Compounds (ug/Kg)																							
PCB 5	NA	NA	NA	NA	NA	NA	NA	NA	4	3	3.80	1.77	3	3	4.77	2.56	2.36	1.05	ND	NA	NA	NA	NA
PCB8	2	1	1.5	1.50	3	0	--	--	4	4	14.3	4.25	3	3	24.3	16.8	0.928	1.05	ND	NA	NA	NA	NA
PCB18	2	2	7.7	6.15	3	3	2.03	1.83	4	4	77.5	21.6	3	3	27.1	18.9	2.47	3.43	1.86	NA	NA	NA	NA
PCB27	NA	NA	NA	NA	NA	NA	NA	NA	4	1	4.88	4.88	3	3	8.96	4.58	0.511	ND	ND	NA	NA	NA	NA
PCB28	2	2	13	11.5	3	3	4.77	4.74	4	4	60.6	19.4	3	2	22.8	15.3	3.73	5.38	3.57	NA	NA	NA	NA
PCB29	NA	NA	NA	NA	NA	NA	NA	NA	4	1	47.3	47.3	3	3	3.86	2.12	1.70	0.916	ND	NA	NA	NA	NA
PCB31	NA	NA	NA	NA	NA	NA	NA	NA	4	4	74.6	24.1	3	3	50.1	34.4	4.59	7.82	6.87	NA	NA	NA	NA
PCB44	2	2	13	12.0	3	3	7.54	7.27	4	4	85.8	25.4	3	3	41.2	25.2	1.49	7.96	4.34	NA	NA	NA	NA
PCB49	NA	NA	NA	NA	NA	NA	NA	NA	4	4	50.1	17.0	3	3	22.5	15.5	2.06	6.09	3.47	NA	NA	NA	NA
PCB52	2	2	17	15.5	3	3	13.1	11.8	4	4	111	37.6	3	3	45.8	32.2	2.48	13.6	7.56	NA	NA	NA	NA
PCB66	2	2	20	18.0	3	3	13.7	12.4	4	4	100	32.3	3	3	97.6	53.8	3.18	11.4	8.45	NA	NA	NA	NA
PCB70	NA	NA	NA	NA	NA	NA	NA	NA	4	4	86.6	30.2	3	3	60.5	41.5	4.15	11.4	8.45	NA	NA	NA	NA
PCB74	NA	NA	NA	NA	NA	NA	NA	NA	4	4	44.5	14.9	3	3	26.4	17.3	1.96	5.42	3.43	NA	NA	NA	NA
PCB87	NA	NA	NA	NA	NA	NA	NA	NA	4	4	29.3	10.7	3	3	16.8	13.2	ND	8.81	5.38	NA	NA	NA	NA
PCB95	NA	NA	NA	NA	NA	NA	NA	NA	4	4	72.0	36.4	3	3	88.9	55.8	1.46	57.7	13.6	NA	NA	NA	NA
PCB97	NA	NA	NA	NA	NA	NA	NA	NA	4	4	14.3	7.06	3	3	17.7	12.7	ND	4.49	4.88	NA	NA	NA	NA
PCB99	NA	NA	NA	NA	NA	NA	NA	NA	4	4	26.6	18.0	3	3	19.6	14.3	1.46	15.1	4.71	NA	NA	NA	NA
PCB101	2	2	24	23.5	3	3	24.8	23.3	4	4	82.9	49.5	3	3	62.4	42.7	2.19	46.4	13.3	NA	NA	NA	NA
PCB105	2	2	7.6	7.20	3	3	9.77	6.51	4	4	29.9	9.75	3	3	21.1	15.8	ND	5.49	5.18	NA	NA	NA	NA

Table 1. Summary of Analytical Results for Samples Collected from the Consolidated Slip

	BPTCP[a] 7/31/92				BPTCP[a] 02/01/1994				BPTCP[a] 07/17/1996 - 07/18/1996				BPTCP[a] 07/17/1996 Depth from 30cm to 90cm				BPTCP[a] 07/17/1996 Depth from 90 cm to 150 cm	BPTCP[a] 07/18/1996 Storm Drain	BPTCP[a] 07/18/1996 End Surface	CH2M HILL 4/12/1994			
ANALYTES[b]	NO. ANALYZED	NO. DETECTS	MAX	ARITHMETIC MEAN	NO. ANALYZED	NO. DETECTS	MAX	ARITHMETIC MEAN	NO. ANALYZED	NO. DETECTS	MAX	ARITHMETIC MEAN	NO. ANALYZED	NO. DETECTS	MAX	ARITHMETIC MEAN	ANALYTICAL RESULTS	ANALYTICAL RESULTS	ANALYTICAL RESULTS	NO. ANALYZED	NO. DETECTS	MAX	ARITHMETIC MEAN
PCB110	NA	NA	NA	NA	NA	NA	NA	NA	4	4	91.4	36.0	3	3	55.9	43.6	1.77	29.6	15.4	NA	NA	NA	NA
PCB118	2	2	18	18.0	3	3	19.1	17.9	4	4	59.1	28.7	3	3	52.2	35.4	1.24	18.2	12.2	NA	NA	NA	NA
PCB128	2	2	4.3	4.20	3	3	5.97	4.47	4	4	9.43	3.27	3	3	13.0	8.46	ND	6.09	3.19	NA	NA	NA	NA
PCB132	NA	NA	NA	NA	NA	NA	NA	NA	4	4	15.7	6.95	3	2	10.7	9.93	0.578	20.4	4.75	NA	NA	NA	NA
PCB137	NA	NA	NA	NA	NA	NA	NA	NA	4	4	2.63	1.54	3	2	2.05	1.98	ND	1.47	0.736	NA	NA	NA	NA
PCB138	2	2	39	38.5	3	3	44.4	43.0	4	4	84.2	55.7	3	3	72.8	55.8	ND	82.1	19.3	NA	NA	NA	NA
PCB149	NA	NA	NA	NA	NA	NA	NA	NA	4	4	139	58.4	3	3	44.9	34.8	1.79	88.2	13.1	NA	NA	NA	NA
PCB151	NA	NA	NA	NA	NA	NA	NA	NA	4	4	69.3	25.3	3	3	18.5	11.3	ND	30.8	4.00	NA	NA	NA	NA
PCB153	2	2	36	35.5	3	3	46.3	42.4	4	4	185	80.7	3	3	63.0	46.2	ND	101	17.1	NA	NA	NA	NA
PCB156	NA	NA	NA	NA	NA	NA	NA	NA	4	4	7.83	5.30	3	3	7.19	5.74	1.14	5.20	2.12	NA	NA	NA	NA
PCB157	NA	NA	NA	NA	NA	NA	NA	NA	4	3	5.76	2.86	3	3	15.4	7.46	9.37	2.17	1.17	NA	NA	NA	NA
PCB158	NA	NA	NA	NA	NA	NA	NA	NA	4	4	7.83	5.30	3	3	7.19	5.74	1.14	5.20	2.12	NA	NA	NA	NA
PCB170	2	2	11	11.0	3	3	16.8	15.1	4	4	42.5	17.9	3	3	26.6	16.7	ND	34.2	4.00	NA	NA	NA	NA
PCB174	NA	NA	NA	NA	NA	NA	NA	NA	4	4	63.5	23.6	3	3	24.3	16.1	ND	34.2	4.00	NA	NA	NA	NA
PCB177	NA	NA	NA	NA	NA	NA	NA	NA	4	4	29.8	11.9	3	3	13.0	9.06	ND	19.8	2.95	NA	NA	NA	NA
PCB180	2	2	35	30.5	3	3	54.8	45.3	4	4	140	58.2	3	3	67.6	44.2	1.26	83.9	11.8	NA	NA	NA	NA
PCB183	NA	NA	NA	NA	NA	NA	NA	NA	4	4	44.1	15.0	3	3	14.7	9.65	ND	17.6	2.59	NA	NA	NA	NA
PCB187	2	2	16	15.5	3	3	22.6	19.7	4	4	84.2	33.4	3	3	34.4	16.3	0.928	41.8	5.19	NA	NA	NA	NA
PCB189	NA	NA	NA	NA	NA	NA	NA	NA	3	3	2.75	1.32	3	3	1.17	1.05	ND	1.30	ND	NA	NA	NA	NA
PCB194	NA	NA	NA	NA	NA	NA	NA	NA	4	4	46.3	17.4	3	3	18.0	11.5	0.712	18.4	3.24	NA	NA	NA	NA
PCB195	2	2	1.9	1.85	3	3	4.32	3.35	4	4	13.2	4.94	3	3	5.83	3.80	ND	6.84	0.958	NA	NA	NA	NA
PCB201	NA	NA	NA	NA	NA	NA	NA	NA	4	4	44.0	17.2	3	3	22.6	14.1	2.70	18.1	3.78	NA	NA	NA	NA
PCB203	NA	NA	NA	NA	NA	NA	NA	NA	4	4	32.6	13.6	3	3	22.6	11.5	1.67	10.9	2.18	NA	NA	NA	NA
PCB206	2	2	2.2	2.10	3	3	5.16	4.80	4	4	13.8	6.90	3	3	13.8	10.6	12.6	6.22	2.68	NA	NA	NA	NA
PCB209	2	0	--	--	3	3	3.61	3.20	4	4	3.02	2.05	3	3	8.94	6.98	11.9	2.23	1.36	NA	NA	NA	NA
Aroclor 1248	NA	NA	NA	NA	NA	NA	NA	NA	4	3	1600	627	3	3	2600	1183	110	160	120	NA	NA	NA	NA
Aroclor 1254	NA	NA	NA	NA	NA	NA	NA	NA	4	2	390	310	2	2	250	240	ND	260	130	NA	NA	NA	NA
Aroclor 1260	NA	NA	NA	NA	NA	NA	NA	NA	4	3	1600	727	3	3	760	480	65.0	730	120	NA	NA	NA	NA
Aroclor 5460	NA	NA	NA	NA	3	3	198	149	4	4	901	257	3	3	302	189	ND	182	183	NA	NA	NA	NA
PCBBATCH	NA	NA	NA	NA	3	3	73.3	73.3	4	4	75.1	75.1	3	3	75.1	75.1	75.1	75.1	75.1	NA	NA	NA	NA
Total Metals and Cyanide (mg/kg)																							
Aluminum	2	2	30000	26000	3	3	58700	50367	4	4	52400	36275	3	3	84600	62900	112000	69700	52300	6	6	27200	18717
Antimony	2	2	4.4	4.05	3	3	3.85	3.53	4	4	29.4	10.4	3	3	52.8	22.777	10.90	6.15	5.11	6	1	6.30	6.30
Arsenic	2	2	18	17.5	3	3	23.9	20.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6	6	15.3	11.6
Barium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6	6	300	203
Beryllium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6	2	0.75	0.550
Cadmium	2	2	2.9	2.85	3	3	2.90	2.77	4	4	7.79	5.01	3	3	8.58	7.01	3.94	14.50	3.79	6	6	2.80	1.99
Calcium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6	6	9540	6612
Chromium	2	2	140	140	NA	NA	NA	NA	4	4	552	216	3	3	468	344	89.80	109.00	91.80	6	6	261	116
Cobalt	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6	6	17.1	13.2
Copper	2	2	200	195	NA	NA	NA	NA	4	4	478	231	3	3	1740	730	144	151	116	6	6	338	164
Iron	2	2	46000	44500	NA	NA	NA	NA	4	4	43000	36625	3	3	44500	39667	55300	37300	37500	6	6	40000	27550
Lead	2	2	170	155	NA	NA	NA	NA	4	4	460	215	3	3	542	417	1590	85.9	91.8	6	6	295	166
Magnesium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6	6	12900	9413
Manganese	2	2	420	385	NA	NA	NA	NA	4	4	484.000	403.250	3	3	547	476	634	306	507	6	6	329	258
Mercury	2	2	0.73	0.645	NA	NA	NA	NA	4	4	3.280	1.177	3	3	2.94	1.76	1.49	0.454	0.319	6	6	1.40	0.650
Nickel	2	2	46	45.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6	6	38.3	30.4
Potassium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6	6	8750	5978
Selenium	2	2	0.64	0.585	3	3	0.765	0.700	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6	2	0.890	0.820
Silver	2	2	0.92	0.905	NA	NA	NA	NA	4	4	2.590	1.221	3	3	2.42	1.84	3.02	0.601	0.472	6	6	5.50	2.88
Sodium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6	6	15300	10177
Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6	1	0.730	0.730
Tin	2	2	8.7	8.35	3	3	5.33	5.17	4	4	4.170	3.155	3	3	9.45	7.33	9.17	4.72	4.46	NA	NA	NA	NA
Vanadium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6	6	79.5	55.8
Zinc	2	2	570	555	3	3	616	562	4	4	477.000	446.250	3	3	737	668	1010	347	265	6	6	542	465
AVS and SEM Concentrations (mg/Kg)																							
SEM_Cadmium	NA	NA	NA	NA	NA	NA	NA	NA	4	4	0.048	0.035	3	3	0.0810	0.0551	0.0624	0.0224	0.0198	NA	NA	NA	NA
SEM_Copper	NA	NA	NA	NA	NA	NA	NA	NA	4	4	1.560	1.338	3	3	1.23	0.930	0.0700	1.38	1.15	NA	NA	NA	NA
SEM_Nickel	NA	NA	NA	NA	NA	NA	NA	NA	4	4	0.300	0.214	3	3	0.799	0.427	0.697	0.211	0.166	NA	NA	NA	NA
SEM_Lead	NA	NA	NA	NA	NA	NA	NA	NA	4	4	1.265	1.000	3	3	2.62	2.20	8.01	1.07	0.777	NA	NA	NA	NA
SEM_Zinc	NA	NA	NA	NA	NA	NA	NA	NA	4	4	9.910	7.763	3	3	12.8	10.4	36.1	6.96	6.20	NA	NA	NA	NA
SEM_Summary	NA	NA	NA	NA	NA	NA	NA	NA	4	4	13.080	10.350	3	3	17.1	14.0	44.9	9.64	8.31	NA	NA	NA	NA

Table 1. Summary of Analytical Results for Samples Collected from the Consolidated Slip

	BPTCP[a] 7/31/92				BPTCP[a] 02/01/1994				BPTCP[a] 07/17/1996 - 07/18/1996				BPTCP[a] 07/17/1996 Depth from 30cm to 90cm				BPTCP[a] 07/17/1996 Depth from 90 cm to 150 cm	BPTCP[a] 07/18/1996 Storm Drain	BPTCP[a] 07/18/1996 End Surface	CH2M HILL 4/12/1994			
ANALYTES[b]	NO. ANALYZED	NO. DETECTS	MAX	ARITHMETIC MEAN	NO. ANALYZED	NO. DETECTS	MAX	ARITHMETIC MEAN	NO. ANALYZED	NO. DETECTS	MAX	ARITHMETIC MEAN	NO. ANALYZED	NO. DETECTS	MAX	ARITHMETIC MEAN	ANALYTICAL RESULTS	ANALYTICAL RESULTS	ANALYTICAL RESULTS	NO. ANALYZED	NO. DETECTS	MAX	ARITHMETIC MEAN
SEM_AVS	NA	NA	NA	NA	NA	NA	NA	NA	4	4	0.085	0.082	3	3	0.0980	0.0723	0.211	0.0860	0.183	NA	NA	NA	NA
Grain Size and Total Organic Carbon Analysis																							
Fines (%)	3	3	92.9	87.3	3	3	NA	94.1	4	4	92.800	75.553	3	3	86.1	81.2	87.2	75.4	59.6	NA	NA	NA	NA
Course Sand (%)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fine Sand (%)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Course Silt ()	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fine Silt (%)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Organic Carbon (% dry weight)	3	3	4.60	4.43	3	3	NA	4.36	4	4	6.410	4.753	3	3	5.20	4.38	6.92	3.96	3.06	NA	NA	NA	NA

Notes:
[a]BPTCP - Bay Protection and Toxic Cleanup Program
[b]Source: CSWRCB et al., 1998; CH2M HILL, 1995. Semi-volatile and Volatile Organic analytical results are not reported here but can be found in the aforementioned reports.
NA - Not Analyzed
ND - Compound was analyzed for but not detected.

Table 2

Proposed Sampling and Analyses

Montrose Surface Water Drainage Pathway

Drainage	Sediment Survey	Selection of Sample Locations	Number of Samples	Sampling Equipment	Analyses	Rationale
Normadie Ave./ Jones Ditch	manual measurements	a) divide into 5 intervals and collect one random sample from each interval **OR**, b) sample 5 distinct sediment deposits - no more than 1 sample per deposit	5	stainless steel trowel	DDT-related, TOC	verification of previous results, characterize current conditions
Kenwood Drain - upstream	check manholes/ catchbasins	sample where sediment is present	2	stainless steel trowel or scoop on extendable handle	DDT-related, TOC	characterize site- vs. non-site-related contamination
Kenwood Drain - downstream	check manholes/ catchbasins	sample where sediment is present	5	stainless steel trowel or scoop on extendable handle	DDT-related, TOC	verification of previous results, characterize current conditions
Torrance Lateral - Above Confluence with the Kenwood Drain	manual measurements	sample where sediment is present	2	stainless steel trowel	DDT-related, TOC	characterize site- vs. non-site-related contamination
Torrance Lateral - Lined Segment	manual measurements	a) divide into 5 intervals and collect one random sample from each interval **OR,** b) sample 5 distinct sediment deposits - no more than 1 sample per deposit	5	stainless steel trowel	DDT-related, TOC	verification of previous results, characterize current conditions
Torrance Lateral - Unlined Segment	manual measurements	a) divide into 5 intervals and collect one random sample from each interval **OR,** b) sample 5 distinct sediment deposits - no more than 1 sample per deposit	5	stainless steel trowel	DDT-related, TOC	verification of previous results, characterize current conditions

Table 2
Proposed Sampling and Analyses
Montrose Surface Water Drainage Pathway

Drainage	Sediment Survey	Selection of Sample Locations	Number of Samples	Sampling Equipment	Analyses	Rationale
Upper Dominguez Channel	manual measurements	a) divide into 2 intervals and collect one random sample from each interval **OR**, b) sample 2 distinct sediment deposits - no more than 1 sample per deposit	2	stainless steel trowel	DDT-related, TOC	characterize site- vs. non-site-related contamination
Dominguez Channel - Segment 1	boat/fathometer	a) map sediments, divide into 5 intervals and collect equispaced locations **OR,** b) map sediment deposits down the channel, sample 5 distinct sediment deposits - no more than 1 sample location per deposit	10 (2 from each core)	boat-mounted vibracore	DDT-related, TOC	verification of previous results, characterize current conditions
Dominguez Channel - Intersectionl with Torrance Lateral **(mid-channel)**	boat/fathometer	map sediment deposits from survey, sample 5 apparent deposits or 5 equispaced locations down the segment	10 (2 from each core)	boat-mounted vibracore	DDT-related, TOC	verification of previous results, characterize current conditions
Dominguez Channel - Intersection with Torrance Lateral **(intertidal zone)**	manual measurements	select 6 equispaced locations along the intertidal zone (3 per side)	6 (3 each side)	stainless steel trowel	DDT-related, TOC	verification of previous results, characterize current conditions

Table 2
Proposed Sampling and Analyses
Montrose Surface Water Drainage Pathway

Drainage	Sediment Survey	Selection of Sample Locations	Number of Samples	Sampling Equipment	Analyses	Rationale
Dominguez Channel - Segment 2	boat/fathometer	a) map sediments, divide into 5 intervals and collect equispaced locations **OR,** b) map sediment deposits down the channel, sample 5 distinct sediment deposits - no more than 1 sample location per deposit	10 (2 from each core)	boat-mounted vibracore	DDT-related, TOC	verification of previous results, characterize current conditions
Dominguez Channel - Segment 3	boat/fathometer	a) map sediments, divide into 5 intervals and collect equispaced locations **OR,** b) map sediment deposits down the channel, sample 5 distinct sediment deposits - no more than 1 sample location per deposit	10 (2 from each core)	boat-mounted vibracore	DDT-related, TOC	verification of previous results, characterize current conditions
Dominguez Channel - Segment 4	boat/fathometer	a) map sediments, divide into 5 intervals and collect equispaced locations **OR,** b) map sediment deposits down the channel, sample 5 distinct sediment deposits - no more than 1 sample location per deposit	10 (2 from each core)	boat-mounted vibracore	DDT-related, TOC	verification of previous results, characterize current conditions

Table 2
Proposed Sampling and Analyses
Montrose Surface Water Drainage Pathway

Drainage	Sediment Survey	Selection of Sample Locations	Number of Samples	Sampling Equipment	Analyses	Rationale
Consolidated Slip	boat/fathometer	divide into 5 equal intervals and collect one random sample from within each interval	15 (3 from each core)	boat-mounted vibracore	DDT-related, TOC	verification of previous results, characterize current conditions
Quality Control Samples						
Field duplicates			Dominguez Channel (all) - 1 per 10 samples All other drainages - 1 per drainage			
Matrix spike/matrix spike duplicates			1 per 20 samples or 1 per sample delivery group (SDG)			
Equipment rinseate			1 per piece of equipment for each set of 20 samples			

Notes:
DDT-related = includes all metabolites and isomers 2,4'-DDD, 2,4'-DDE, 2,4'-DDT, 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT.
TOC = total organic carbon